

WO 2005/078835

PCT/JP2005/002197

25

## CLAIMS

1. A fuel cell system comprising:
  - a fuel cell supplied with fuel and oxidizer to generate electric power;
  - a heating mechanism executing a heating to the fuel cell;
  - 5 a temperature detector detecting a temperature of the fuel cell; and
  - a controller operative to calculate a temperature drop speed of the fuel cell, during a period in which the temperature of the fuel cell is lowering, using the temperature of the fuel cell detected by the temperature detector to control the heating mechanism such that the temperature drop speed is kept equal to or less
  - 10 than a given speed.
2. The fuel cell system according to claim 1, wherein the controller causes the heating mechanism to start to execute the heating to the fuel cell when the temperature drop speed exceeds the given speed.
3. The fuel cell system according to claim 2, further comprising an environment
- 15 temperature detector detecting an environmental temperature of the fuel cell, wherein the controller causes the heating mechanism to start to execute the heating to the fuel cell when the environmental temperature is equal to or less than zero degree.
4. The fuel cell system according to claim 2, wherein the controller raises a
- 20 heating capacity of the heating mechanism in case where after the heating mechanism has started the heating, the temperature drop speed does not become equal to or less than the given speed.
5. The fuel cell system according to claim 2, wherein the controller lowers a
- 25 heating capacity of the heating mechanism in case where after the heating mechanism has started the heating, the temperature drop speed becomes equal to or less than a second given speed lower than the given speed.
6. The fuel cell system according to claim 3, wherein the controller stops the heating mechanism in case where a temperature difference between the temperature of the fuel cell and the environmental temperature becomes equal to
- 30 or less than a given temperature difference.

WO 2005/078835

PCT/JP2005/002197

26

7. The fuel cell system according to claim 6, wherein the controller restarts the heating of the heating mechanism in case where after the heating mechanism has stopped the heating, the environmental temperature further lowers and the temperature drop speed further exceeds the given speed.

5 8. The fuel cell system according to claim 1, further comprising a resistance value detector detecting a resistance value of the fuel cell,

wherein the controller estimates a moisture content remaining in an inside of the fuel cell based on the resistance value, detected by the resistance value detector, and varies a value of the given speed depending on the moisture content.

10 9. The fuel cell system according to claim 8, wherein the controller estimates the moisture content remaining in the inside of the fuel cell after executing a purging of the fuel cell.

10. The fuel cell system according to claim 3, wherein the controller estimates the temperature drop speed based on a temperature difference between the  
15 temperature of the fuel cell and the environmental temperature.

11. The fuel cell system according to claim 1, wherein the heating mechanism includes an electric heater that takes a secondary battery as a heat source.

12. The fuel cell system according to claim 1, wherein the heating mechanism includes a coolant supply mechanism that heats coolant and supplies the same to  
20 the fuel cell.

13. The fuel cell system according to claim 12, wherein a heat source heating the coolant includes an electric heater that takes a secondary battery as a power supply.

14. The fuel cell system according to claim 1, wherein the heating mechanism  
25 heats the fuel cell utilizing a heat built up by catalytic combustion between the fuel and the oxidizer in the fuel cell.

15. A fuel cell system comprising:

a fuel cell supplied with fuel and oxidizer to generate electric power;

heating means for executing a heating to the fuel cell;

30 temperature detection means for detecting a temperature of the fuel cell; and

WO 2005/078835

PCT/JP2005/002197

27

control means, by calculating a temperature drop speed of the fuel cell, during a period in which the temperature of the fuel cell is lowering, based on the temperature of the fuel cell detected by the temperature detection means, for controlling the heating means such that the temperature drop speed is kept equal to or less than a given speed.

16. A method of controlling a fuel cell system having a fuel cell supplied with fuel and oxidizer to generate electric power, the method comprising:
- detecting a temperature of the fuel cell;
  - calculating a temperature drop speed, during a period in which the temperature of the fuel cell is lowering, using the temperature of the fuel cell; and
  - executing a heating to the fuel cell such that the temperature drop speed is kept equal to or less than a given speed.